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Risk Perceptions and Management Strategies of Rice Growing Households: Evidence from a Developing Country

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ABSTRACT

Rice crop is an important grain crop all over the world and innumerable risks can make rice crop highly vulnerable, leading to undesirable impact on crop productivity as well as farmers' livelihood. In this lieu, a survey was conducted among 400 rice growing households in Punjab Province of Pakistan, to seek the perceptions of risks and strategies carried out for its proper management. Therefore, factor analysis was applied to determine the perceptions of rice farmers regarding sources of risk and management strategies. Results revealed that majority of rice growing farmers' alleged different kinds of risks. Supply of inputs (not available timely) with a mean value of 4.35 was identified as the most vital among risk sources. Also, off-farm work was recognized as the highest risk management strategy with a mean value of 4.27. Further, regression was applied to validate. The capital management factor was significant with an R^2 of 0.833, indicating that83% variation that is covered by the independent variables with high satisfaction.

KEYWORDS: Off-farm work; risk perceptions; environmental risk, rice crop; inputs supply, factor analysis; regression model; Pakistan

1. INTRODUCTION

Agriculture is crucial to human endurance and provides food, fuel and other ecosystem services. In the world of uncertainty, every person attempts to craft his strategies after great observation and tries to forestall every likely event. In the modern agricultural food system numerous fatalities are caused by unpredictable incidents for which odds are not recognized, even though idiosyncratic prospects can be conjured by expert opinions[1]. Therefore, it is necessary to keep consider that risk is an inevitable and unavoidable part of life particularly in farming system. Nevertheless, agricultural activity is risk-prone because farmers hardly manage some part of the production process. Though, natural disorders are beyond the farmer's control that might have substantial impacts. Yet, every decision-maker still has to face risks in their decision-making[2]–[4].

In addition, it's realized that risk is a real event or real peril and precisely assessable[5]. Different scholars have divulged that farmers are very cautious of those activities which are high in investment and are riskier in expected output and diverge towards failure[6]–[9]. These risks are significantly associated with the price, production, income, finance and institutions[8], [10]. It is usually observed that rain at proper time is likely for crop productivity, but can damage the productivity at the time of harvesting[11]. In general, assessing risk is a three step process as given:(1) risk perception, (2) risk management and (3) risk strategies to tackle the risk. In agriculture, risk perception is stated as strategic decision making. Risk is categorized into two clusters (i) business risk comprising of production, market, price, natural, institutional and (ii) personal risks which often affects livelihood of farmers[12], [13]. Additionally,[4]stated that agriculture sector is accompanied by irregular climatic conditions, insects and pest infestations, and anomaly of prices of commodity. Farmers face numerous risk in cropping and income diversification is one of their lead coping strategy [14]. Environmental and climate change associated risks make crops exposed [15].Timely and precise discernment of risks may also assist farmers to appraise the probability and consequences of disclosed risks[16].The assessment of the farmer's perceptions and their response to risks are very important due to its importance in observing the decision making behavior of farmers at the time of fronting uncertain situation[17]–[19].

Concerning food security in Asia, rice has still center of attention. Up till now, the role of rice production is vital in alleviating poverty and hunger. Gradually the poor consume more rice and are usually dependent on rice. Despite the fact is that ninety percent of the world's rice is produced and consumed in the Asia[67]. Hence, its supply must increase at least by twofold till 2050 to cope with the demand of growing population[20].

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Swiftly increasing population, deteriorating per capita arable land and availability of water are the core dilemmas of agriculture in Pakistan. Water shortage is the main issue for the cereal crops and farmers have to rely primarily on ground water [21]. As the aggregate agriculture area has remained almost equivalent since liberation[22]. In Pakistan rice is an essential cash crop, second staple food after wheat. It earns foremost foreign exchange after cotton. During the second quarter of 2013, rice export earned US$ 1.667 billion of foreign exchange. Although, during 2013-14 cropping period rice area was expanded and cultivated on 2.79 million hectares giving produce of 6.79million tons[23].However, impressive yield of rice was not achieved under numerous uncertainties.

Moreover, farmers face public institutional issues and economic constraints. Although, public institutions are also working at tehsil(sub-district) level in the research area, but are non-resourceful. In contrast, the private sector is evolving with inadequate access to the society[24]. Several other factors like terrestrial position, socio-demographic variables and organizational structure whom affect the farmers level of enthusiasm, objectives and opinion about risks, ultimately affect the farmers cost and profit related decisions[25].Thus, several other factors i.e. weeds and diseases are the leading constraints that impact on farmers' decision making regarding management strategies in the rice-wheat cropping system [26]–[28].

For improvement of rice production practices and per acre yield it is essential to understand the risks of farmers in rice-wheat cropping areas in Pakistan [29]. Even-though, various studies have been done on numerous aspects of risks in agriculture sector globally. But limited research attention is given to the rice growing households on farm level risk perception and management so far. Hence, keeping in view of there search gap, in this study our intention is to reconnoiter risks sources and management strategies by the rice farmers, and risk factors manipulating farmers' decision making process.

2. Conceptual framework and methodology

2.1. Description of Study area

The present study was investigated in Punjab province of Pakistan, geographically situated in the region of 30°00′ N, 70°00′ E in the semiarid plains [30]. It is the second largest and most populated province and has a leading role in development of the economy. The total cultivated area of the province accounts for 56.2 percent, and contributes 53 percent to the total agricultural GDP and cereal production contributes 74 percent in the country[31].It has 58% share in total rice production with sharing of 3.1 and 0.7 percent of the value added and in the country's agricultural GDP respectively[31].The rainfall anomaly tendency has a dispersed assortment, almost two-third of precipitation occurs in monsoon season i.e. June to September[32].Mean annual precipitation varies i.e. 96 cm and 46 cm. There are mainly two cropping seasons i.e. Rabi (November-April) and Kharif (May-October). Main crops cultivated in the area are wheat, rice, sugarcane and maize.

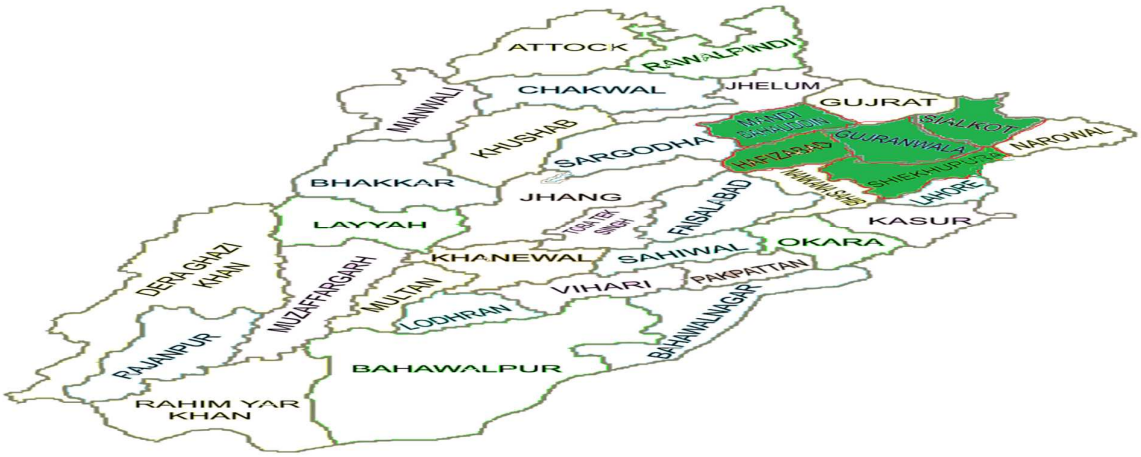

Figure 1: Map of Punjab with Study Area (green area shows study region)

2.1.1 Sampling Strategy

The cross-sectional data was recorded from 400ricegrowing farmers. For the stratification, multi-stage cluster sampling technique was applied (see Table-1).In stage-1 five districts were selected as major rice producing districts i.e. Hafizabad, Sialkot, Gujranwala, Mandi Baha-ud-din and Sheikhupura. In addition, 2 sub-districts were selected from each district and 40 farmers were randomly interviewed from each sub-district.

Table1. Sampling framework of the study:

Province	Districts	Sub-district	Sample Size
Punjab	Hafizabad	Hafizabad	40
		Pindi Bhattian	40
	Sialkot	Symbryal	40
		Daska	40
	Gujranwala	Gujranwala	40
		Wazirabad	40
	Mandi Baha-ud-din	Mandi Baha-ud-din	40
		Malakwal	40
	Sheikhupura	Sheikhupura	40
		Ferozwala	40
Total			400

2.2. Analytical Procedure

The collected data was entered and analyzed through SPSS-20(*Statistical Package for Social Sciences*). Descriptive statistics of farmers' perceptions and strategies were analyzed. Afterwards Explanatory Factor Analysis technique was applied as recognized by[33], [34].The response of farmers regarding risks sources and their strategies for managing the risks was measured on a five points (1 to 5) based likert scale, i.e. "1" for strongly disagree to "5" for strongly agree. Likert scale is a very useful tool for measuring a wide variety of issues[35].Data regarding farmer's characteristics was also collected.

2.2.1 Factor Analysis

Factor analysis is a statistical approach for estimating the dimensionality for bundle of variables. In this approach latent variables describe unobserved and are deliberated as factors/dimensions. Exploratory Factor Analysis(EFA) is remnant of Structural Equation Modelling (SEM) practice[36].It is applicable for a multifarious research practices such as education, psychology, marketing, management and health sciences.Hence, for this study we use exploratory factor analysis with varimax rotation (*orthogonal rotation*). Explanatory factor analysis (EFA)is a technique which depicts a great amount of variables to a reduced amount of variables and provides a simple structure and factors explain as much variance as possible[37]. The factor analysis model reveals variation and co-variation in a set of observed continuous variables as under.

Hence, y (j = 1 to p) is a factors 'function η (k = 1 to m.) and,

Residual ε. (j = 1 to p.)for person i,

$$Y_{i1} = V_1 + \lambda_{11}\eta_{i1} + \lambda_{12}\eta_{i2} + \cdots + \lambda_{1k}\eta_{ik} + \cdots \lambda_{1m}\eta_{im} + \varepsilon_{i1}$$
$$Y_{ij} = V_j + \lambda_{j1}\eta_{i1} + \lambda_{j2}\eta_{i2} + \cdots + \lambda_{jk}\eta_{ik} + \cdots + \lambda_{jm}\eta_{im} + \varepsilon_{ij}$$
$$Y_{ip} = V_p + \lambda_{p1}\eta_{i1} + \lambda_{p2}\eta_{i2} + \cdots + \lambda_{pk}\eta_{ik} + \cdots + \lambda_{pm}\eta_{im} + \varepsilon_{ip}$$

Whereas, V_j designates constant, λ_{jk} denotes factor loading, η_{ik} denotes factor values and ε_{ij} specifies residual values with zero means and relationships of zero with the factors. Hence, the following model is derived in the form of matrix;

$$Y_i = V + \Lambda.\eta_i + \varepsilon_i$$

Hereafter, V denotes as vector of intercept v_j, Λrepresents as factor loading matrix λ_{pk}, ψ denotes as factor variances/covariance matrix and, residual variances/covariance matrix represents by Θ.

While, Σ denotes matrix of covariance of observed variables with population and,

$$\Sigma = \Lambda.\Psi.\Lambda' + \Theta$$

Where,

Λ *represent pattern of* factor

$\Lambda.*\Psi$ denotes correlation between factors and items of factor structure

$\Theta jj < 0$ *represents* Heywood's case

$\hat{\eta}_l$ denote scores of factor

Factor scores quality; (correlation between $\hat{\eta}\iota$ and η_i) means determinacy of factors

Further the risk sources and risk strategies were distributed in several factors according to rotated component matrix table or orthogonal varimax rotation table. Standardized factor scores for each farmer were saved to derive regression. Kaiser-Mayer-Olkin (KMO), Cronbach's alpha technique and communalities techniques were

applied to decide the correlation and reliability of the data for factor analysis. Finally, ordinary least square (OLS) regression was applied to assess the association among farm and farmers' attributes and risk sources and risk management strategies.

3. RESULTS AND DISCUSSION

3.1. Farm and farm characteristics of rice farmers

Descriptive statistics of demographic characteristics of rice farmers are portrayed in Table-2.Results divulge that mean age of rice farmer was 45 years with about 7 dependents. The literacy rate among farmers was 7 years of formal education having 24 years of farming experience including 20 years of rice growing experience on an average farm size of 14 acres. Further results indicate the mean distance of farm from the main city was around 13 kilometers from where the farmers market their farm needs.

Table 2. Farm and Farm characteristics of rice farmers:

Characteristics	Unit	Mean	S.D
Age	Years	45.89	9.153
Family members	Numbers	6.91	1.411
Education	Years	7.21	4.618
Farming experience	Years	24.02	9.779
Ricefarming experience	Years	20	8.879
Distance from main city	Kilometers	13.18	7.155
Farming area	Acres	13.93	9.363
Monthly Income	PKR	31124	38372

Source: field survey 2015

3.2. Determinates for participation in off-farm activities

The potential motivations of rice farmers partaking in off farm activities are elucidated in Table-3. The significant reasons revealed by farmers were placed by Z score ranking technique. Which is commonly used for ranking purpose[38]. According to Z score, low income from agriculture sector was ranked 1st indicating as the core reason of farmers' off-farm participation activities. To raise family income was ranked 2nd reason for rice farmers. Further the famers ranked burden of large family size as 3rd for participation in off-farm activities. Moreover, reduction of income risk from agriculture was ranked 4th, these results resemble with [39]. Investment for agriculture was rank 5th and availability of off-farm opportunity was ranked as 6th reason for farmers' participation in off-farm Activities.

Table 3. Reasons for participation in off-farm activities:

Reasons	Z Score	Ranking
Low income from agriculture	1.43	1
To raise family income	1.26	2
Burden of large family size	0.24	3
Reduction of income risk from agriculture	0.16	4
Investment for agriculture	-0.02	5
Availability of off-farm opportunity	-1.05	6

3.3. Reliability and adequacy of data

For testing the reliability and adequacy of the data Kaiser-Meyer-Olkin (KMO), Bartlett's test, and Cronbach's alpha tests were applied, further communalities were calculated.

3.3.1. The KMO test

The KMO test calculates sampling acceptability and diverges between 0 and 1. If KMO value is 1, then it means each variable is completely fore told with no error by the other variables. Here forth for the current data the KMO value was 0.815 for risks sources and 0.834 for risk management strategies (Table 4). In literature,[40] suggested that KMO ≥0.50 is acceptable. Hence, in this study the values attained were more than 0.80, indicating that arrangement of correlation was pretty compact for factor analysis. Bartlett's test of sphericityand$\chi^2$for the risk sources was 6,842.93 and for management strategies Bartlett's test of sphericity and χ^2 was 12,013.54, which were substantially acceptable (Table 4).

Table4. KMO and Bartlett's Test of Sphericity for Risk sources and Management strategies

Risk Sources			Management Strategies		
KMO Measure of Sampling Adequacy		.815	KMO Measure of Sampling Adequacy		.834
Bartlett's Test of Sphericity	Approx. Chi-Square	6842.931	Bartlett's Test of Sphericity	Approx. Chi-Square	12013.544
	Df	351		df	406
	Sig.	.000		Sig.	.000

3.3.2. Cronbach's Alpha

For determining the reliability of the data, Cronbach's alpha test was also applied. The internal consistency of reliability is based on the extent of response to a certain question and similarly for others[41]. Whereas, the Cronbach's alpha was tested and reliability of data was 0.828 and 0.823 for risk sources and management strategies respectively, which is acceptable as it acceded 0.7 (Table 5).

Table 5. Cronbach's Alpha Reliability of Risk perception and Management Strategies

Component	Risk Perception	Risk Management Strategies
Number of Items	24	20
Reliability	0.828	0.823

3.3.3 Communalities

The sum of the loadings of a variable with all extracted factors is called communality. If the communalities convert into lesser the significance of sample size increases [42]. Table 6 and 7depicts the results concerning communalities to continue of factor loadings. Communalities are denoted as:-

$$\hat{h}_i = \sum_{j-i}^{m} . \hat{l}_{ij}^2 .$$

Where, $\hat{h}_i$ is communality value with i^{th} items, $\sum_{j-i}^{m}$.is sum of factors loadings and $\hat{l}_{ij}^2$. is square of factor loadings.

3.4. Farmer's Perception regarding Sources of Risks

In total, twenty four risk sources were presented in the perception of rice growing farmers. Respondents were probed to give scores for each source of risk from 1 (strongly disagree) to 5 (strongly agree) to utter how eloquent they considered each risk source to rice crop. Table 6 exhibits mean and standard deviation for each risk source, which was estimated from the farmer's perception. The sources of risk are given in descending order as consequences to the respondents. Supply of inputs not in time was appraised on the top having mean value 4.35 for rice growers. Having a standard deviation of less than 1, stated that rice farmers are harmonized to accept it as the highest risk source[43]. Timely availability of different inputs at required time is a challenge for the rice growers in the study area. These findings also coincide with [33]. High price of inputs was the 2nd imperative risk source with a mean value of 4.06. Various researches in agriculture have revealed that input price risk influences production [8], [18], [33].

The mean value for fluctuation in product prices was 3.96 and it was ranked as 3rd important risk source, these results are in line with [9], [44], [45].The next important risk source was natural disasters having mean value 3.95; these results are similar with the findings by [46] that natural calamities (flooding) damaged the infrastructure in Iran. Furthermore, rice disease in risk source was ranked at 4th with mean value 3.91.However, [27], [28] also indicated that diseases and weeds were the main constraints to increase the production of cereal crops in Pakistan. Comparable results can also be revealed from a variety of studies [45], [47], [48]. Lack of information was the next risk source with mean value 3.85. Likewise,[49]revealed that farmers in Sindh province of Pakistan are lacking information regarding agriculture sector. Furthermore, farmers revealed that drying of river and underground water was also an important risk source with 3.85 mean value. Infrastructure having mean value 3.83 was also found an important risk in the study area. Fluctuation of interest rate was the next important risk source having 3.81 mean value and exploitation from middle man was ranked as next risk source having average value 3.79, comparable remarks can be seen in [18].

Inadequate extension services and severe weather condition were also found as risks with mean values of 3.78 and 3.77 respectively. Similar findings were stated by [18]. Political and foreign market uncertainty, excessive rainfall, production uncertainty, lack of contract growing were found as sources of risk with average values 3.75, 3.72, 3.71, 3.59 and 3.57 respectively. Farmer's perception for the changes in agricultural policies averaged 3.54 as another source of risk. Likewise, changes in government and agricultural policies was an important effective risk source relating to farmers [18], [50]. Likewise, [51] conducted a study and analyzed the agriculture policies and exposed positive and negative impact of policies on agriculture sector. Moreover, lack of farmers' cooperatives had a mean value (3.53), lack of keeping farm record (3.49), insufficient machinery (3.42), market dishonesty (3.38), insufficient family labour (3.37) and no supply of private capital having mean value (2.90) were also found as risk sources. Likewise, capital markets are associated with risk source [52]. Also, related findings were reported by [15], [33], [34].

Hereafter, five factors were confined through factor analysis for the risk sources using principle component extraction method. Table-6 portrays the five factors and their relevant loading items (having value>0.40). The names of factors from 1 to 5 are given as: e*nvironmental and market, institutional, technological, financial and production, and labour*, respectively. Factor 1 was named as *environmental and marketing* had high loading factors on lack of information sources, fluctuation in interest rate, exploitation from middleman, uncertainty in foreign market policy change, lack of farmers cooperatives, lack of keeping farm record, market dishonesty and no supply of private capital. Factor 2 was *Institutional* consisting of high Prices of inputs, natural disasters, lack of information sources, infrastructure, excessive rainfall, lack of keeping farm record, market dishonesty and production uncertainty. Factor 3 named as *Technological* which includes severe weather condition, political

unrest (strike) and lack of contract growing. Factor 4 was named as *Financial*, including fluctuation in product prices, inadequate extension services, changes in agricultural local policies and market dishonesty. Factor 5 was named as *Production and Labour* consisting of supply of inputs not in time, rice diseases, drying of river and underground water and insufficient family labour. In the existing study factor analysis values of factor loading higher than 0.40 are reflected as significant[18].

Table 6. Factor Loading Matrix of Risk Sources

Risk Sources	Mean	SD	Factors					Commun ality
			1	2	3	4	5	
Supply of inputs not in time	4.35	0.528	.035	.117	-.071	-.008	**.822**	0.696
High Prices of inputs	4.06	0.867	.146	**.878**	.048	.003	.008	0.795
Fluctuation in product prices	3.96	0.781	-.018	.174	.004	**.706**	.116	0.543
Natural disasters (flood, calamities)	3.95	0.824	.115	**.709**	-.005	-.026	-.067	0.521
Rice disease (Pest etc.)	3.91	0.745	.019	-.017	.164	-.020	**.679**	0.535
Lack of information sources	3.85	0.712	**.448**	**.466**	.096	.046	.023	0.430
Drying of river and underground water	3.85	0.734	.270	.345	-.104	-.038	**.532**	0.589
Infrastructure	3.83	0.838	**.448**	**.467**	.021	.045	.006	0.421
Fluctuation interest rate	3.81	0.795	**.774**	.372	-.019	.028	.008	0.739
Exploitation from middleman	3.79	0.753	**.703**	-.008	-.024	-.074	-.012	0.500
Inadequate extension services	3.78	0.868	-.043	-.017	.135	**-.840**	.010	0.726
Severe Weather Condition	3.77	0.718	.150	.043	**.749**	.028	.030	0.587
Political unrest (strike)	3.75	0.785	.011	.023	**.871**	-.023	.068	0.764
Uncertainty about foreign market prices / policy change	3.72	0.8	**.802**	.151	-.051	.104	.021	0.680
Excessive rain fall	3.71	0.766	.028	**.928**	-.026	.065	.070	0.872
Production uncertainty	3.59	0.911	.046	**.932**	.052	.013	-.018	0.874
Lack of contract growing	3.57	0.77	-.076	-.070	**.869**	-.008	.031	0.767
Changes in agricultural local Policies	3.54	0.803	.136	-.069	-.112	**.671**	-.067	0.549
Lack of farmers cooperatives	3.53	0.797	**.799**	.138	.064	.017	.036	0.663
Lack of keeping farm record	3.49	0.873	**.782**	.152	.058	.032	.058	0.642
Insufficient machinery	3.42	0.858	.034	.081	-.034	**.923**	.071	0.866
Market dishonesty	3.38	0.852	**.935**	-.055	-.011	.001	.054	0.880
Insufficient family labour	3.37	0.889	-.021	-.007	-.095	-.155	**.620**	0.418
No supply of private capital	3.34	0.863	**.945**	-.038	-.022	-.008	.065	0.899
Percentage of the total variance			28.819	9.242	8.433	6.994	6.701	
Cumulative percentage of total variance			28.819	38.06	46.49	53.48	61.78	

Note: Factor loading >0.4 are highlighted in **bold**. The name of factors for 1, 2,3,4,5 are *Environmental and Market, Institutional, Technological, Financial and Production, and Labour* respectively.

3.5. Farmer's Perception of Risk Management Strategies

Perception of risk management strategies were organized under 20 foremost variables. Table-7 depicts that farmer's confirmed off-farm income as the leading strategy for risk management having mean value 4.27. In various earlier studies, findings divulged that farmers' purchasing power is diminishing and are suffering financially. For that reason, off-farm income is a significant way for risk management to overcome these issues [50], [53]. Income diversification is used as coping strategy of farmers against various risk [14]. Small dams/ turbine scheme stood 2nd as risk management strategy with a mean value of 4.18 which is inadequate for water storage/saving facility trend. Similarly, [22], [54], [55], have also invoked for water saving strategy, as it also reflects the necessity for risk management. Low input price was the 3rdrisk management strategy affirmed by the rice farmers with a mean value of 4.08 and encouraged the findings of previous studies [56], [57]. Contract farming and weather forecast, were mentioned as risk management strategies with same mean value 3.96. Majority of farmers rely on contract farming in the sense that they purchase fertilizer, seed and other inputs from commission agent on credit and sell their produce to the agent at harvesting. Direct contact with processors and bank loan assurance was the next significant risk strategy with mean value 3.95. In earlier studies the same findings were stated by [58], [59].

Moreover, up-to date market information with mean value 3.92 was also reported an important risk management strategy. Improve market facility with mean value 3.89 was another risk management strategy. The next strategy keeping farm record (3.88) was reported. Spreading sales and Market monitoring (input and output price) having same mean values (3.87) were the next strategies for risk management carried out by the rice growers. Similarly, having crop insurance (3.79), adopt new technology (3.77) were also positively quantified by the farmers as a risk management strategy. Crop insurance as risk management strategy was revealed in various previous studies [60]–[64]. For instance, [64] revealed that rice crop insurance has positive effect as coping strategy and was

adopted by the Indonesian rice farmers. Others risk management strategies were, planning of expenditures (3.72), removal of middleman influence (3.71), personal insurance (3.55), on farm storage (3.49), use of technical consulting/training (3.45) and production diversity (3.41) respectively. Likewise, [14] and [65] indicated in their studies that crop diversification was an important coping strategy against the risk in agriculture sector.

For risk management strategies factor analysis was applied. Further five factors were assimilated and accumulating total variance of 64.08% (Table 7). These five factors explain 64% of variance with significant Bartlett's test of sphericity.

Table 7. Factor Loading of Risk Management Strategies

Risk Management Strategies	Mean	SD	Factors					Communality
			1	2	3	4	5	
Off-farm income/work	4.27	0.528	-.045	-.083	.081	.078	**.633**	0.422
Make Small dames / Turbine	4.18	0.558	**.713**	.032	.118	.028	-.049	0.527
Low input prices	4.08	0.809	**.621**	.107	.058	-.044	-.011	0.403
Contract farming	3.96	0.787	**.820**	.027	.147	-.025	.048	0.698
Weather forecast	3.96	0.712	-.064	-.016	.010	**.912**	-.032	0.837
Direct contact with processors	3.95	0.722	.059	.059	.030	-.028	**.939**	0.890
Assurance of bank loan	3.95	0.734	**.969**	.001	-.058	-.008	-.008	0.942
Up-to date market information	3.92	0.833	-.005	-.006	-.029	**.966**	-.001	0.934
Improve market facility	3.89	0.953	**.586**	.022	.373	-.032	.000	0.484
Keeping farm record	3.88	0.985	**.978**	.004	-.054	-.011	.002	0.960
Spreading Sales	3.87	0.784	.049	**.937**	.010	-.022	-.002	0.881
Market monitoring	3.87	0.755	-.003	-.007	-.031	**.974**	-.010	0.950
Having crop insurance	3.79	0.868	.044	.100	**.685**	.084	.081	0.495
Adopt new technology	3.77	0.797	.097	**.676**	.030	-.065	-.090	0.449
Planning of expenditures	3.72	0.886	.082	.055	**.914**	.007	.051	0.848
Removal influence of middleman	3.71	0.751	.279	.034	**.872**	.026	.075	0.846
Personal insurance	3.55	0.684	**.842**	-.002	-.057	-.047	-.030	0.715
On farm storage	3.49	0.801	.064	.069	.039	-.002	**.936**	0.886
Use of technical consulting/training	3.45	0.83	**.975**	-.004	-.026	-.008	.023	0.952
Production Diversity	3.41	0.808	.072	**.905**	-.030	-.013	-.033	0.826
Percentage of the total variance			27.863	10.569	9.678	8.801	7.169	
Cumulative percentage of total variance			27.863	38.432	48.110	56.911	64.080	

Note: Factor loading >0.40 are shown in bold. The names of risk management strategies factors are *Credit, Information and development, Capital, Market monitoring and input reservation* and mentioned as 1, 2,3,4,5 respectively.

3.6. Relationship of farm and farmer's attributes with perception of risk sources

Ordinary Least Square (OLS) regression was applied on the five factors obtained through factor analysis, for determining the relationship among the farmers' demographic profile and perceptions of risk sources. The acquired factors were further used as dependent variables in regression analysis. Table 8illuminates the sale to middle man, access to market, primary source of income, and household annual income exhibited positive relationship with environmental and marketing risk factor. Which means that sale to middle man, access to market, primary source of income, and household annual income was more important. Hence, education, distance from city, and visit of agriculture extension agent had negative relation. It is intuiting that farmers have less importance regarding these factors. These findings coincide with [18].While regarding institutional risk factor, education, sale to middleman and agricultural extension visit to farm had positive relation which means farmers have high perceptions of these factors regarding institutional risk comparatively access to market information and full time farming,. Analogous findings were also observed in other studies[34], [50].

Furthermore, age, education, total farming area, primary source of income (agricultural) and agricultural extension visit to farm has positive relation. While, only household access to market information has negative relation with technological risk factor. Likewise results were also revealed by[34], [50].Education, family size, household's annual income and primary source of income have positive relation with financial risk source. However, access to market information has negative relation with financial risk factor. Likewise, [18], [49] exemplified financial risk as an important risk factor and farmers are probing strategies to overcome financial risk in agriculture. Similarly, Production and labour risk factor was positive and significantly influenced by age, education, primary source of income and household annual income. However, producing successor, household market information, agriculture extension visit to farm had negative relation. Hence our findings are in line with prior studies [34], [50].

All variables entered in the models are significant with any one of the dependent variable and also overall model was significant because f-value for all regressions was significant. The value of $R^2$and adjusted R^2 is low in some models. This phenomenon was also observed in [18] related to risk perception due to different perceptions of risk sources from respondent to respondent.

Table 8. Regression results between farm and farmer characteristics and risk source factors

Independent Variables	Unit	Dependent Variables				
		Environmental and Marketing	Institutional	Technological	Financial	Production and Labour
Age	Years	.011	.013	.008*	-.025	.012*
Farming Experience	Years	-.003	-.014	-.005	.025	.003
Education	Years	-.002*	.015*	.021**	.021*	.017*
Total farming area	Acres	.000	.006	.010*	.000	.003
Family size	Numbers	-.049	-.038	-.019	.013**	.041
Distance from main city	Kilometers	-.017**	.007	.018*	-.005	.002
Household annual income	PKR	2.236E-006*	-6.438E-006	1.085E-006	1.156E-005**	4.184E-005*
Primary source of income[a]		.277*	.030	.213*	.218*	.084**
Full time farmer[b]		.057	-.216*	-.123	-.117	-.022
Sale to middle man[c]		.002**	.033*	-.195	.027*	-.013
Producing successor[d]		.219	-.005	-.191	.111	-.091*
Agricultural extension visit to farm[e]		-.199*	.216*	.179*	.193	-.148*
HH access to market information[f]		.094*	-.063*	-.282**	-.023*	-.179*
Adjusted R^2		0.564***	0.498***	0.438***	0.363***	0.379**

Note*: Variables are significant at p* < 0.10; p** < 0.05; p*** < 0.01. [a] Measured as dummy variable 1 = primary sources of income agriculture and 0 otherwise. [b]Calculated as dummy variable 1= full-time and 0 otherwise. [c]Measured as dummy variable 1= product sold to agent or middle man and 0 otherwise. [d]Calculated as dummy variable 1=respondent producing successor and 0 otherwise .[e]Indicates dummy variable 1 = agricultural extension department visit to farm and 0 otherwise.[f]Indicates 1 = HH access to market information and 0 otherwise.*

3.7. Perceptions regarding risk management strategies related to farm and farmers attributes

Table 9summarizes the linear regression models exploring the relationship among farm and farmers' characteristics. Risk sources perception factors and management activities for the rice farmers in study area. The result divulges that more farming experience and more educated farmers distinguished credit management as an imperative strategy. These findings can be compared with previous studies[43], [66].Moreover, age and sale to middleman was considered less important to credit risk management strategy. Information and development was associated with higher education, distance from city, agriculture extension visit and access to market information was considered more important management strategy. While those farmers who sell their product to the middleman, didn't give much importance to this strategy. These findings coincide with[43].

Furthermore, education, primary source of income and access to market has positive effect on the capital as a crucial management strategy. And distance from city has negative relationship with capital management strategy. Market monitoring factor was associated with education and agriculture extension visit as risk management strategies. Nonetheless, household annual income had negative effect with market monitoring. Similar findings were portrayed by[43]. Also, input reservation factor appeared to be a key strategy to reduce risks by the farmers whom depend much upon age, farm size, agriculture as primary source of income, agriculture extension visit. Though, results are in line with[18]. However, less farming experience, small family size, no full time farming, producing successor and access to market information wasn't considered a good strategy[50].

Table9. Effect of different variables on risk management strategies

Independent Variables	Unit	Dependent Variables				
		Credit	Information and Development	Capital	Market Monitoring	Input reservation
Age (year)	Years	-.017***	.003	.006	.015	.031***
Farming experience (years)	Years	.015**	.002	-.005	-.012	-.029***
Education (years)	Years	.002**	.007**	.003**	.011**	.008
Total farming area (acres)	Acres	-.001	-.002	-.002	.001	.006*
Family size	Numbers	.010	-.024	-.024	-.001	-.050*
Distance from main city (km)	Kilometers	.002	.004*	-.467**	-.006	.001
House hold annual income	PKR	-7.528E-006	2.485E-005	1.434E-006	-1.591E-005*	-5.793E-007
Primary source of income[a]		0.051	0.842	.079*	0.154	0.198*
Full time farmer[b]		-0.156	.088	-0.021	0.017	-0.293*
Sale to middle man[c]		-.062*	-.029	.071	.042	.004
Producing		-.040	-.046	.032	.064	-.079

successor[d]					
Agricultural extension visit to farm[e]	.032	.121***	.008	.316***	.266*
HH access to market information[f]	.025	.006**	.052**	-.085	-.099*
Marketing	.945***	-.010	.044**	.022*	-.037
Institutional	.003**	.070**	.911***	-.010	.060**
Technological	.008*	.007**	.020**	.633	-.055
Financial	.003**	.917	.047***	-.057*	-.073**
Production and Labour	.046***	.075	-.071**	-.008	.751***
Adjusted R^2	0.542***	0.320***	0.833***	0.437***	0.674***

Note*: Variables are significant at p* < 0.10; p** < 0.05; p*** < 0.01. [a] Measured as dummy variable 1 = primary sources of income agriculture and 0 otherwise. [b]Calculated as dummy variable 1= full-time and 0 otherwise. [c]Measured as dummy variable 1= product sold to agent or middle man and 0 otherwise. [d]Calculated as dummy variable 1= respondent producing successor and 0 otherwise. [e]Indicates dummy variable 1 = agricultural extension department visit to farm and 0 otherwise. [f]Indicates 1 = HH access to market information and 0 otherwise.*

The regression results also indicate that farmer's risk perception significantly influences their economic behavior. For instance, farmers whom anticipated marketing risk being more important risk source disclosed their affection to adopt the strategies like credit, capital and market monitoring as management strategies. These results are alike to [15], [18]. Institutional risk is related with capital, information and development, capital and input reserve management. Farmers whom perceived technological risk, they focused to adopt the strategies of credit, information and development and capital management. Financial risk source had positive association with credit and capital management, while negative with market monitoring and employment and input reserve management. Likewise, it is indicated in earlier study that a mixture of technology, use of land and market access is the most effective approach for the sustainable inputs such as water conservation [21]. Similarly, [49] indicated that capital and financial support encourages farmers for increasing agriculture production. Furthermore, production and labour risk factor is associated with the credit, capital and input reserve management activities. Previous studies indicated that there's no 1:1 alliance between sources of risk and management strategies [18].

4. Conclusion

In conclusion, the study revealed alluring outcomes. Though, farmers generally were conscious with numerous kinds of risk. In accordance with their knowledge and experience, no timely supply and high price of inputs, uncertainty of output price, natural disaster were the most likely sources of risk. According to rice farmer's perception, off-farm work, on low prices and timely supply of inputs, construction of small dams/turbine scheme, supporting price of rice from the government and providing loans could be effective to manage the risks. Moreover, there's passably, dissension between deliberation of sources of risk and management strategies, mainly due to deprived socio-economic background. Yet, farm and farmers' characteristics perceptibly influenced the perception of risk sources and management strategies.

In view of the outcomes, it is proposed that government and private sectors should focus on the prices of inputs and outputs in agriculture sector, especially in the rice farming. Furthermore, investments should be made for building dams and turbine schemes. Provide off-farm services to the rice farmers to spend their leisure time and earn for investment in agriculture sector. Also, enabling to manage risks better and enhancing the production of rice to mitigate food insecurity. In addition, policy makers should also focus on crop insurance to reduce the perils such as flood, drought etc. These perceptions and preferences of risk are duly to understand the effectiveness for cereal crops especially rice, and approximation of rice production for future research.

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